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(54) Title: SEAFOOD PRODUCT AND PROCESS

(57) Abstract: A process for preparing ready-to-cook seafood is described. The process comprising the steps of: (a) locating the seafood in a ready-to-cook container; (b) sealing the container under partial, substantial or full vacuum; and (c) allowing the container and seafood to undergo ultra high hydrostatic pressure. Thus, the seafood remains "raw", i.e. uncooked, but is at least partially sterilised from infectious agents. The seafood also retains its spores and enzymes, hence its taste and quality. The effect of at least partial sterilisation of the product within the container during the hydrostatic pressure and any added gas mixture provides a product with a significantly extended shelf life, from several days to possibly several weeks, facilitating easier subsequent storage, transportation and sales.

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1 "Seafood Product and Process"

2

3 The present invention relates to ready-to-cook,
4 hermetically sealed pre-packed food, including
5 seafood, and especially shellfish, that has been
6 hydrostatically pressurised alive or very fresh in
7 order to maintain highest product qualities.

8

9 Processing fish and shellfish suitable for
10 supermarket shelves is an expensive and difficult
11 exercise. This is primarily due to the fact that
12 shellfish and other fish items must be processed
13 alive or as fresh as possible to give a high quality
14 end product.

15

16 The main spoilage mechanisms affecting the quality
17 of fish and seafood products are the result of
18 microbial and oxidative activities. Fish and other
19 seafood are very perishable due to their high Aw,
20 neutral pH, and the presence of autolytic enzymes,
21 which cause the rapid development of undesirable
22 odours and flavours.

1 Currently, live fish and shellfish are stored in
2 tanks or ponds on fishing vessels, and trucked in
3 tanks or containers for processing or transport to
4 the market place. These tanks or containers are
5 naturally heavy and are very costly loads to carry,
6 contributing to the overall expense and risk
7 associated with volatile and delicate products like
8 fresh fish and shellfish.

9
10 The use of cold sterilisation using ultra high
11 hydrostatic pressure in hyperbaric chambers as a
12 method for seafood preservation is known. However,
13 after processing using hydrostatic pressure, the
14 seafood is presented without any form of protection.
15 The absence of suitable packaging for the processed
16 product will result in a considerable loss of
17 structural integrity and connectivity.

18
19 Other methods of preservation involve the use of
20 high temperatures, for example pasteurisation, but
21 they degrade the original and natural texture
22 quality of the seafood meat..

23
24 It is an object of the present invention to provide
25 an improved product and process that uses the ultra
26 high hydrostatic pressurised technique, but which
27 has the advantage of packaging the seafood in a
28 hermetically sealed, sterile container, thereby
29 providing the customer with sterilised seafood
30 having retained raw qualities in a "ready to cook"
31 format.

32

1 According to one aspect of the present invention,
2 there is provided a process for preparing "ready to
3 cook" seafood comprising the steps of:

4
5 (a) locating the seafood in a ready to cook
6 container;

7
8 (b) sealing the container under partial,
9 substantial or full vacuum; and

10
11 (c) allowing the container and seafood to undergo
12 ultra high hydrostatic pressure.

13

14 Thus, the ultra high hydrostatic pressurisation
15 provides at least partial sterilisation of the
16 seafood. The seafood remains "raw", i.e. uncooked,
17 but is at least partially sterilised from infectious
18 agents. The seafood also retain its spores and
19 enzymes, hence its taste and quality. The effect of
20 at least partial sterilisation of the product within
21 the container during the hydrostatic pressure and
22 any added gas mixture will provide the product with
23 a significantly extended shelf life, from several
24 days to possibly several weeks, facilitating easier
25 subsequent storage, transportation and sales.

26

27 Such sterilisation is 'cold', as opposed to the more
28 general heated sterilisation which typically occurs
29 at >100-120°C. The seafood product of the present
30 invention still requires cooking to effect heated
31 sterilisation of the seafood, but the cooking can be
32 effected from the same (sealed) container.

1
2 The added quality of using a sealed and sterile
3 container for the hydrostatic processing and for the
4 subsequent presentation is that shellfish will
5 retain its original appearance and colours. In the
6 case of bivalve molluscs, the container will keep
7 the bivalve shells in a closed form, whereby the
8 meat will still be contained within the two shells.
9 An effect of hydrostatic pressure above a minimum
10 pressure and during a minimum period of time is to
11 open the shells and separate the meat from the shells.
12 A sufficiently vacuum-drawn and sealed container will
13 prevent the shells from opening and the meat from
14 falling out.
15
16 Furthermore, in particular in the case of crustaceans,
17 the combination of hydrostatic pressure and sealed
18 containers will preserve the original and natural
19 colour of the shells for a considerable period of time
20 (i.e. from a few days to a few weeks after
21 processing).
22
23 The atmosphere in the container could be altered
24 before sealing. The degree of vacuum forming depends
25 on the nature of the seafood, and the nature of any
26 other content of the container, including any
27 'different' atmosphere. Essential though is to keep
28 the seafood, particularly bivalve molluscs,
29 'closed', i.e. as close to the live condition as
30 possible. This is achieved by sealing the container
31 and maintaining the seal until cooking, and possibly
32 eating.

1

2 Preferably the ultra high hydrostatic pressurisation
3 of the seafood comprises exposing the seafood to
4 pressures greater than 2000 bar, more usually more
5 than 3000 bar, in a hyperbaric chamber for at least
6 0.5 seconds and temperature range between -10 and
7 80°C, at least once. One such exposure is termed a
8 pressure cycle.

9

10 Preferably the seafood undergoes a plurality of
11 pressure cycles.

12

13 Preferably the seafood is a bivalve shellfish.

14

15 Any suitable shellfish can be used with the present
16 invention, including molluscs and crustaceans such
17 as mussels, clams, scallops, crabs, lobsters, etc.

18

19 Preferably the shellfish are punctured so as to
20 render them more suitable for hydrostatic treatment;
21 generally to release air from inside the shellfish.

22

23 Preferably the pressurised seafood is enveloped by a
24 hermetically sealable container. More preferably,
25 such a container is made from a suitably heat
26 resistant and durable plastic. This could be a
27 durable but flexible bag, in which the seafood is
28 ready to cook.

29

30 The term "ready to cook" as used here refers to
31 something which is capable of immediate cooking,

1 such as boiling, without further preparation. The
2 seafood is then cooked in the container.

3
4 Preferably the container further comprises top
5 opening mechanism and/or a handle, for pressure
6 relief during cooking.

7
8 Preferably the seafood is packed in the container in
9 or separately with one or more cooking ingredients
10 such as a sauce; this allows cooking of the seafood
11 with a desired flavour or taste without removal from
12 the container.

13
14 The seafood could be packaged with other food
15 products that can be ultra high hydrostatically
16 pressurised (and subsequently cooked) alongside the
17 seafood.

18
19 In one embodiment of the present invention, seafood
20 is sealed in a container with one or more suitable
21 gases such as carbon dioxide, oxygen and nitrogen,
22 possibly as a mixture (e.g. containing 35%-45%
23 carbon dioxide, 25%-35% oxygen and 25%-35% nitrogen)
24 that will be compressed during hydrostatic pressure,
25 and return to its initial volume afterwards. The gas
26 (mixture) with the seafood's own juices and possible
27 added sauces and vegetables would also prevent
28 compression of the package against the shells,
29 avoiding structural damage.

30

1 The seafood could be enveloped in other containers,
2 e.g. double wrappings. Other suitable ready to cook
3 packagings are known.

4

5 According to a second aspect of the present
6 invention, there is provided a ready to cook seafood
7 product whenever prepared by a process of the
8 present invention.

9

10 Preferably the seafood is a shellfish.

11

12 Embodiments of the present invention will now be
13 described by way of example only, with reference to
14 the accompanying drawings in which:

15

16 Fig. 1 is a diagrammatic representation of a
17 hermetically sealed stand-up pouch with pressurised
18 mussels packed inside; and

19

20 Fig. 2 is a diagrammatic top view of a stand up
21 pouch enveloping two semi-vacuumed and sealed stand-
22 up pouches, one of which contains pressurised crabs
23 and the other pressurised mussels.

24

25 Figure 3 is a hermetically sealed plastic tray
26 containing pressurised mussels, suitable for
27 microwaving.

28

29 Referring to the Figures, Figure 1 shows a semi-
30 vacuum sealed stand-up pouch 1 with ultra high
31 hydrostatically pressurised mussels 2 packed inside.
32 The pouch 1 has an easy to carry handle 4 and a top

1 opening mechanism 6. The pouch 1 could equally
2 carry other seafoods such as crabs, etc.

3
4 Figure 2 shows a second stand-up pouch 8 containing
5 two semi-vacuum sealed stand-up pouches 10 and 12
6 with ultra high hydrostatically pressurised mussels
7 22 packed in one pouch 10 and ultra high
8 hydrostatically pressurised crabs 14 packed inside
9 the other pouch 12. A further handle 24 and opening
10 mechanism 26 are also provided therewith.

11
12 Figure 3 shows ultra high hydrostatically
13 pressurised mussels 32 packaged in a microwave-able
14 container 30 which comprises a box 33 and a
15 hermetically sealed plastic lid 34. The mussels 32
16 are surrounded by a garlic sauce and vegetables 36.

17
18 In production of the above products, air is expelled
19 from the shellfish-containing stand-up pouch 1 (or
20 pouches 10, 12 or container 30), and a gas mixture
21 comprising 35-45% carbon dioxide, 25-35% oxygen and
22 25-35% nitrogen is introduced. The pouch 1 is then
23 hermetically sealed, and then placed in a hyperbaric
24 chamber. The sealed stand-up pouch is then treated
25 under a pressure greater than 3000 bar, at 25°C, for
26 1 minute. This is a "pressure cycle".

27
28 After at least one half-second hydrostatic pressure
29 cycle, the mussels 2 no longer retain connectivity
30 between the mussel body parts and their inner
31 surfaces.

32

1 The airtight semi vacuum sealed pouch 1, containing
2 the mussels 2 and the gas mixture, is now ready to
3 be cooked. It can be stored for at least several
4 days, possibly up to several weeks, at between 0°C
5 and 2°C. Before cooking, the pouch top is opened,
6 using the opening mechanism 6, in order to allow
7 complete heat transfer and venting of steam during
8 the cooking process, especially when the contents
9 are microwaved.

10

11 The present invention provides a process for a
12 simple seafood product that has extended shelf life,
13 whilst retaining their rawness, and thus taste and
14 quality for the consumer, in a cookable form already
15 familiar to the customer.

16

17 Furthermore the stand-up pouch provides the
18 advantage of the use of only one container to hold
19 the shellfish for both the hydrostatic
20 pressurisation and the cooking, as well as transport
21 and 'selling'.

22

23 Other containers, such as hermetically sealable
24 trays, can be used that can withstand the
25 hydrostatic pressure process, but which are also
26 capable of use in microwave ovens.

1 Claims

2

3 1. A process for preparing ready-to-cook seafood
4 comprising the steps of :

5

6 (a) locating the seafood in a ready-to-cook
7 container;

8

9 (b) sealing the container under partial,
10 substantial or full vacuum; and

11

12 (c) allowing the container and seafood to
13 undergo ultra high hydrostatic pressure.

14

15 2. A process as claimed in Claim 1 wherein the
16 pressurisation of the seafood comprises
17 exposing the seafood to a pressure cycle
18 comprising a pressure greater than 2000 bar for
19 at least 30 seconds and within a temperature
20 range of between -10 and 80°C.

21

22 3. A process as claimed in Claim 2 wherein the
23 pressure is greater than 3000 bar.

24

25 4. A process as claimed in Claim 2 or Claim 3
26 wherein the seafood undergoes a plurality of
27 pressure cycles.

28

29 5. A process as claimed in any one of Claims 1 to
30 4 wherein the seafood is a shellfish,
31 preferably a bivalve shellfish.

32

- 1 6. A process as claimed in Claim 5 where the
2 shellfish is one or more of the group
3 comprising mussels, clams, scallops, crabs and
4 lobster.
5
- 6 7. A process as claimed in Claim 4 or Claim 5
7 wherein the shellfish remains closed after
8 pressurisation.
9
- 10 8. A process as claimed in any one of Claims 4 to
11 6 wherein the shellfish wholly or substantially
12 maintains its colour after pressurisation.
13
- 14 9. A process as claimed in any one of Claims 4 to
15 8 wherein the shellfish is or are punctured
16 prior to pressurisation.
17
- 18 10. A process as claimed in any one of the
19 preceding Claims wherein the container is
20 hermetically sealed.
21
- 22 11. A process as claimed in any one of the
23 preceding Claims wherein one or more cooking
24 ingredients are located with the seafood in the
25 container, and sealed therewith.
26
- 27 12. A process as claimed in anyone of the preceding
28 Claims wherein the seafood and container are
29 located in a further container or packaging.
30

- 1 13. A seafood product whenever prepared according
2 to a process of any one of the preceding
3 Claims.
4
- 5 14. A seafood product according to Claim 13
6 enveloped in a hermetically sealed pouch or
7 container.
8
- 9 15. A seafood product as claimed in Claim 14
10 wherein the pouch or container is formed from a
11 heat-resistant and durable plastic material.
12
- 13 16. A seafood product as claimed in anyone of
14 Claims 13 to 15 wherein the container includes
15 a top opening mechanism.
16
- 17 17. A seafood product according to any one of
18 Claims 13 to 16 which includes one or more
19 cooking ingredients.
20
- 21 18. A seafood product as claimed in Claim 17
22 wherein the one or more cooking ingredients is
23 selected from the group comprising sauces,
24 vegetables, herbs, spices, oils, or a
25 combination thereof.
26
- 27 19. A shellfish product as claimed in any one of
28 Claims 13 to 17 wherein the seafood is a
29 shellfish, preferably a bivalve shellfish.
30
- 31 20. A seafood product as claimed in Claim 19
32 wherein the shellfish is one or more of a group

1 comprising mussels, clams, scallops, crab and
2 lobster.

3

4 21. A seafood product as claimed in Claim 19 or
5 Claim 20 wherein the shellfish is closed after
6 the pressurisation.

7

8 22. A seafood product in any one of Claims 19 to 21
9 wherein the shellfish wholly or substantially
10 maintains its colour after the pressurisation.

11

12 23. A seafood product as claimed in any one of
13 Claims 13 to 22 wherein the container is
14 located in a further container or packaging.

15

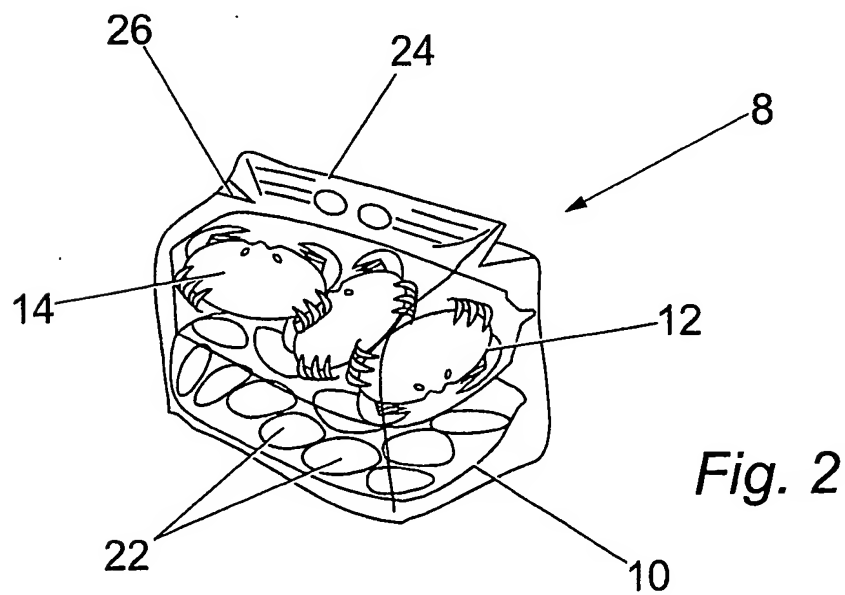
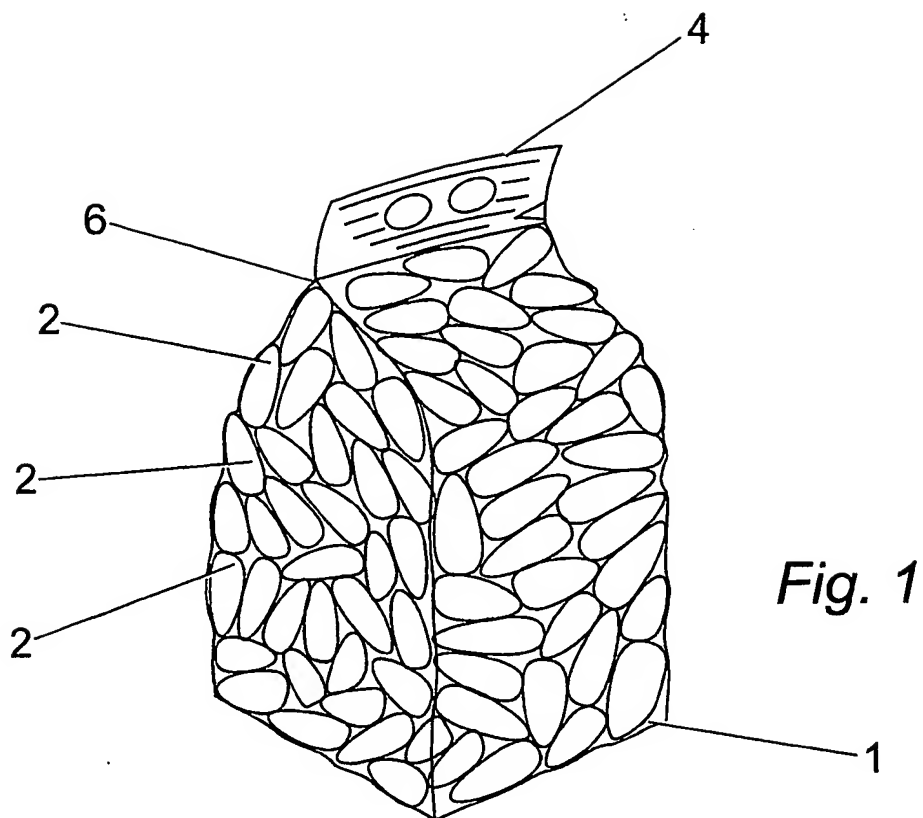
16 24. A seafood product as claimed in anyone of
17 Claims 13 to 23 wherein the seafood is sealed
18 in the container with one or more gases.

19

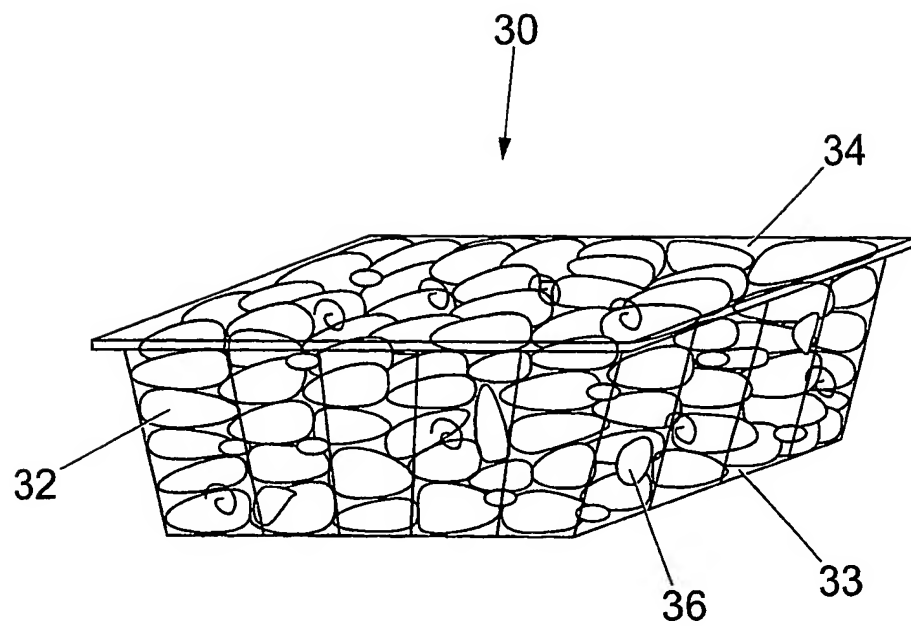
20 25. A seafood product as claimed in Claim 24
21 wherein the gas is one or more selected from
22 the group comprising carbon dioxide, oxygen and
23 nitrogen.

24

1 / 2



2 / 2

*Fig. 3*